

From the INTERNATIONAL BUREAU

PCTNOTIFICATION CONCERNING
TRANSMITTAL OF COPY OF INTERNATIONAL
PRELIMINARY REPORT ON PATENTABILITY
(CHAPTER I OF THE PATENT COOPERATION
TREATY)

(PCT Rule 44bis.1(c))

To:

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| Date of mailing (<i>day/month/year</i>) 02 March 2006 (02.03.2006) | | |
| Applicant's or agent's file reference 09991-042WO1 | | IMPORTANT NOTICE |
| International application No. PCT/US2004/026964 | International filing date (<i>day/month/year</i>) 18 August 2004 (18.08.2004) | |
| | | Priority date (<i>day/month/year</i>) 18 August 2003 (18.08.2003) |
| Applicant DIMATIX, INC. et al | | |

The International Bureau transmits herewith a copy of the international preliminary report on patentability (Chapter I of the Patent Cooperation Treaty)

| | |
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| The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland | Authorized officer Dorothee Mülhausen |
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PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44*bis*)

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| Applicant's or agent's file reference 09991-042WO1 | FOR FURTHER ACTION | See item 4 below |
| International application No. PCT/US2004/026964 | International filing date (<i>day/month/year</i>) 18 August 2004 (18.08.2004) | Priority date (<i>day/month/year</i>) 18 August 2003 (18.08.2003) |
| International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237 | | |
| Applicant DIMATIX, INC. | | |

1. This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 *bis*.1(a).

2. This REPORT consists of a total of 7 sheets, including this cover sheet.

In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.

3. This report contains indications relating to the following items:

- | | | |
|-------------------------------------|--------------|---|
| <input checked="" type="checkbox"/> | Box No. I | Basis of the report |
| <input type="checkbox"/> | Box No. II | Priority |
| <input type="checkbox"/> | Box No. III | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability |
| <input type="checkbox"/> | Box No. IV | Lack of unity of invention |
| <input checked="" type="checkbox"/> | Box No. V | Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |
| <input type="checkbox"/> | Box No. VI | Certain documents cited |
| <input type="checkbox"/> | Box No. VII | Certain defects in the international application |
| <input type="checkbox"/> | Box No. VIII | Certain observations on the international application |

4. The International Bureau will communicate this report to designated Offices in accordance with Rules 44*bis*.3(c) and 93*bis*.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44*bis*.2).

| | |
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| The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland | Date of issuance of this report 21 February 2006 (21.02.2006) |
| Facsimile No. +41 22 740 14 35 | Authorized officer <div style="text-align: center; font-weight: bold; margin-top: 10px;">Dorothee Mülhausen</div> |
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PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

REC'D 16 JUN 2005

PCT WIPO PCT

To:
CHRISTOPHER C. BOWLEY
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WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

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|--|--|
| Date of mailing (day/month/year) 14 JUN 2005 | |
| FOR FURTHER ACTION See paragraph 2 below | |
| Applicant's or agent's file reference 09991-042WO1 | |
| International application No. PCT/US04/26964 | International filing date (day/month/year) 18 August 2004 (18.08.2004) |
| Priority date (day/month/year) 18 August 2003 (18.08.2003) | |
| International Patent Classification (IPC) or both national classification and IPC IPC(7): B41J 29/38 and US Cl.: 347/10.11, 68 | |
| Applicant SPECTRA, INC. | |

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

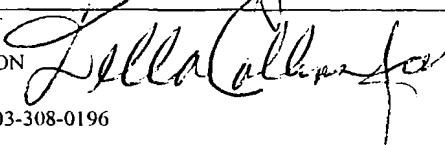
2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

| | |
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| Name and mailing address of the ISA/ US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (703) 305-3230 | Authorized officer WILLIAM DIXON  Telephone No. 703-308-0196 |
|--|--|

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US04/26964

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This opinion has been established on the basis of a translation from the original language into the following language _____, which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

a. type of material

☐ a sequence listing

☐ table(s) related to the sequence listing

b. format of material

☐ in written format

☐ in computer readable form

c. time of filing/furnishing

☐ contained in international application as filed.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

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International application No.
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Box No. V Reasoned statement under Rule 43 bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

| | | |
|-------------------------------|----------------------------------|-----|
| Novelty (N) | Claims <u>6 and 9</u> | YES |
| | Claims <u>1-5, 7-8 and 10-29</u> | NO |
| Inventive step (IS) | Claims <u>NONE</u> | YES |
| | Claims <u>1-29</u> | NO |
| Industrial applicability (IA) | Claims <u>1-29</u> | YES |
| | Claims <u>NONE</u> | NO |

2. Citations and explanations:

Please See Continuation Sheet

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US04/26964

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

V. 2. Citations and Explanations:

Claims 1-5, 7-8 and 10-29 lack novelty under PCT Article 33(2) as being anticipated by Murakami et al. (US 4563689).

Referring to claims 1, 13, 27:

Murakami et al. discloses an apparatus that is an ink jet print head (column 4, lines 2-5) comprising a plurality of droplet ejection devices, each said droplet ejection device including a fluid chamber (FIG. 1a, element #) having a volume and an ejection nozzle (FIG. 1a, element 14), an electrically actuated displacement device (FIG. 1a, element 7 and FIG. 11b, element) that moves between a displaced position and an undisplaced position to change

said volume of said chamber as a capacitance associated with the electrically actuated displacement device changes in charge between an actuated condition and an unactuated condition (column 4, line 67 to column 5, line 8. A voltage applied to both plates of a piezoelectric becomes a voltage waveform similar to the charge and discharge characteristics of a capacitor), and a first switch (FIG. 10b, elements Tr3, Tr4 that has a first input connected to an electric source terminal (FIG. 1a, element + 3), a first output connected to said electrically actuated displacement device (FIG. 10b, element 8), and a first control signal input (FIG. 10b, element INPUTB) to determine whether said first input is connected to or disconnected from said first output, and an electric source that is connected to distribute an electrical signal to said first inputs of said plurality of droplet ejection devices (FIG. 10b, element + V3), and a controller that provides respective charge control signals to respective said first control signal inputs to control the extent of change in charge on respective said capacitances by the time that the respective said first switch connects said electrical signal to the respective said

electrically actuated displacement device (FIG. 10b.. The corresponding unit that outputs INPUT B and INPUTA signals such as TIME(14) in FIG. 12).

Referring to claim 2: wherein said electrically actuated displacement device moves between a displaced position and an undisplaced position as a capacitance associated with the electrically actuated displacement device changes between a charged, actuated condition and an uncharged, unactuated condition (column 4, line 67 to column 5, line 8. A voltage applied to both plates of a piezoelectric becomes a voltage waveform similar to the charge and discharge characteristics of a capacitor) and wherein said controller that provides respective charge control signals to respective said first control signal inputs to control the extent of charge placed on respective said capacitances by the time that the respective said first switch connects said electrical signal to the respective said electrically actuated displacement device (FIG. 11a-b).

Referring to claims 3, 15: wherein each said droplet ejection device also includes a second switch (FIG. 10b, element Tr5, TR6) that has a second input connected to a discharging electrical terminal (FIG. 10b, element -V4), a second output connected to said electrically actuated displacement device (FIG. 10b, element 8), and a second control signal input (FIG. 10b, element INPUTA) to determine whether said second input is connected to or disconnected from

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

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Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

said second output, and wherein said controller provides respective discharge control signals to respective said second control signal inputs to control discharge of the charge on said respective capacitances.

Referring to claim 4: wherein each said droplet ejection device comprises a first resistance between said electric source and said electrically actuated displacement device (FIG. 10b, element VR: The resistor FA connects the electric source + V3 to the piezoelectric 8 during a charge period).

Referring to claim 5: wherein each said droplet ejection device comprises a second resistance between said discharging electrical terminal and said electrically actuated displacement device (FIG. 10b, element VR: The resistor VR connects the discharge electric source -V4 to the piezoelectric 8 during a discharge period).

Referring to claim 7: wherein a single resistance is used to charge and discharge a respective capacitance (FIG. 10b, element VR).

Referring to claim 8: wherein a plurality of resistors, voltages and switches are connected to each said electrically actuated displacement device and controlled by said controller to change the charge on said capacitance (FIG. 10b).

Referring to claims 10-12: wherein said electrical signal is a controlled voltage signal, a controlled current signal, or a constant current (FIG. 10b, INPUTA and B).

Referring to claim 14: wherein said first control signal terminates the connection of said constant voltage to said electrically actuated displacement device when the charge on said electrically actuated displacement device is at a predetermined value which is less than said constant voltage (FIG. 10b and FIG. 11a-b: Since the amplitude of signal M is equal to the subtraction of + V3 to the sum of VCE of Tr3 and VVR, the amplitude of signal M is less than V3).

Referring to claim 16: wherein electrically actuated displacement device is a piezoelectric actuator (column 4, line 67 to column 5, line 8: A voltage applied to both plates of a piezoelectric becomes a voltage waveform similar to the charge and discharge characteristics of a capacitor).

Referring to claims 17-19: wherein said first control signals are controlled to provide uniform droplet volumes or velocities from said plurality of droplet ejection devices or to provide predetermined different drop volumes or velocities from different droplet ejection devices so as to provide pay scale control (column 3, lines 65-68: Since the ink droplet size can be freely changed the drop volumes can be controlled to be uniform or at predetermined value).

Referring to claim 20: wherein said first and second control signals are controlled to connect said electrical signal to respective said electrically actuated displacement devices for respective predetermined times (FIG. 9a-b).

Referring to claim 21: wherein respective said first control signals are controlled to connect said electrical signal to respective said electrically actuated displacement devices until respective said electrically actuated displacement devices achieve respective predetermined charge voltages (FIG. 11a-b).

Referring to claims 22-23: wherein said first control signals are controlled to provide a voltage that is insufficient to eject a droplet, but is sufficient to move a meniscus of a liquid at an ejection nozzle of said droplet ejection device (column 4, lines 13-17: Said preceding pulse not having enough energy for the ink to be ejected from the nozzle).

Referring to claims 24-25: wherein said first control signals are controlled to inject noise into images being printed so as to break up possible print patterns and banding (column 2, lines 37-40: The noise is the satellite droplets).

Referring to claim 26: wherein said first and second control signals are controlled to vary the amplitude of charge as well as the length of time of charge on said electrically actuated displacement device for the first droplet out of a droplet ejection device so as to match subsequent droplets (column 6, lines 20-25: Changing the pulse height and width of the pulse).

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Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Referring to claim 28: wherein said controller includes a field programmable gate array on a circuit board mounted to a monolithic body in which said pumping chambers are formed (FIG. 12).

Referring to claim 29: wherein said controller controls said first switch as a function of the frequency of droplet ejection to reduce variation in drop volume as a function of frequency (column 6, lines 20-25).

Claims 6 and 9 lack an inventive step under PCT Article 33(3) as being obvious over Murakami et al. (US 4563689) in view of Nakano et al. (US 5359350). Murakami et al. discloses the claimed invention as discussed above except wherein each said droplet ejection device has a first resistance that is between said electrical source and said electrically actuated displacement device and is external of an electrical path from said electrically actuated displacement device to said second switch, and further comprising a second resistance that is included in the electrical path from said electrically actuated device to said discharging electrical terminal and wherein said discharging electrical terminal is at ground. Nakano et al. discloses a driving circuit for an ink jet printing head including a first resistance (Fig. 7A, element 29) that is between an electrical source (Fig. 7A, element 33: The resistance 29) is connected to the voltage source 33 during the charge period in which the switch 31 is on) and an electrically actuated displacement device (Fig. 7A, element 34) and is external of an electrical path from said electrically actuated displacement device to a second switch (Fig. 7A, element 39), and further comprising a second resistance (Fig. 7A, element 30) that is included in the electrical path from said electrically actuated device (Fig. 7A, element 34) to a discharging electrical terminal that is at ground (Fig. 7A: During the discharge period the discharge current from the piezoelectric 34 goes through resistor 30 and transistor 32 to ground. Therefore, it would have been obvious for one having ordinary skill in the art at the time invention was made to modify the driving circuit disclosed by Murakami et al. such as including the first and second resistance as disclosed by Nakano et al. The motivation for doing so would have been to be able to adjust the discharging time and the charging time of the piezoelectric element by changing the value of the resistors 30 and 29 as taught by Nakano et al. (column 9, lines 20-24).